Selection in Unsolicited Ratings: the Case of the Sovereign Debt Market

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Abstract

This paper aims at contributing to the debate on whether unsolicited ratings are strategically motivated. I present evidence from the sovereign debt market that strategic motivation is not necessarily behind the patterns that we see in the data and propose a model of credit ratings and ancillary services that abstracts from strategic considerations. In my model, borrowers with different unobservable characteristics select themselves into different solicitation groups. In equilibrium, the model can generate either a negative or a positive selection on unsolicited ratings, depending on the share of unsolicited ratings in a given market. The economic mechanism analyzed in this paper implies a "natural" degree of market selection which is not associated to strategic motivation.

JEL Classification: G24; H63; G20.

Keywords: Unsolicited ratings; Sovereign debt; Rating Agencies, Ancillary services.

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1 Introduction

Unsolicited ratings are opinions about the creditworthiness of the borrower that are not initiated nor paid for by the issuer. Standard and Poor's (S&P) has been issuing unsolicited ratings since 1996. Moody's and Fitch - the other two biggest rating agencies - have been doing it as well.[1] Since the majority of the rating agencies (CRAs) receive compensation from the issuer, one could wonder why the rating agencies would want to issue a rating for which they do not receive fees.

Fulghieri et al. (2014) propose a strategic motivation for unsolicited ratings. They argue that unsolicited ratings can be used as threat to pressure issuers towards solicitation. This model implies that unsolicited ratings have to be lower on average than solicited ones and this fact is consistent with the empirical literature.[2]

Further evidence on the difference between solicited and unsolicited ratings is brought by Bannier et al. (2010). They compare the *ex-post* default probabilities of similar non-U.S. borrowers with solicited and unsolicited S&P ratings between January 1996 and December 2006 and find that, conditional on a rating, default probabilities are different across the two groups. The unsolicited rating group has lower default rates, which might be an indication that rating agencies choose to rate those borrowers more strictly compared to solicited ones.

Understanding whether lower unsolicited ratings are motivated by strategic considerations of the rating agencies is important for policy. For example, the rating agency Moody's had been subjected to an antitrust investigation in 1996 by America's Justice Department, which suspected that the agency's practice of issuing unsolicited ratings on companies might be "a way to force them to pay up for the full service" (The Economist, 2001).

In this paper, I argue that lower average unsolicited rating grades and a lower probability of default in unsolicited ratings vis-à-vis the same solicited ratings do not necessarily imply the strategic use of lower ratings by the rating agencies. Different types of firms might select themselves into soliciting or not soliciting ratings depending on their characteristics. For example, more solvent firms may reasonably expect higher grades on average and thus have more incentives to solicit a rating. Unsolicited ratings are, therefore, more likely to be assigned to lower quality firms.

An argument against the strategic motivation of the CRA for giving unsolicited ratings is the fact that, in the sovereign market, unsolicited ratings have higher grades - not lower - than solicited ones. Figure 1 reports the histograms of Moody's unsolicited and solicited

[1] At least since 2000 and 2001, respectively, Moody's and Fitch have recognised issuing unsolicited ratings (Behr and Guettler, 2008) but they were possibly doing it before that.

[2] Evidence that unsolicited ratings are associated with lower grades is broad in the empirical literature (Poon and Firth, 2005; Poon and Chan, 2010; Van Roy, 2013).

sovereign grades between 2010 and 2015. The distribution of unsolicited ratings has more weight to higher grades compared to that of solicited ratings. The unconditional mean of

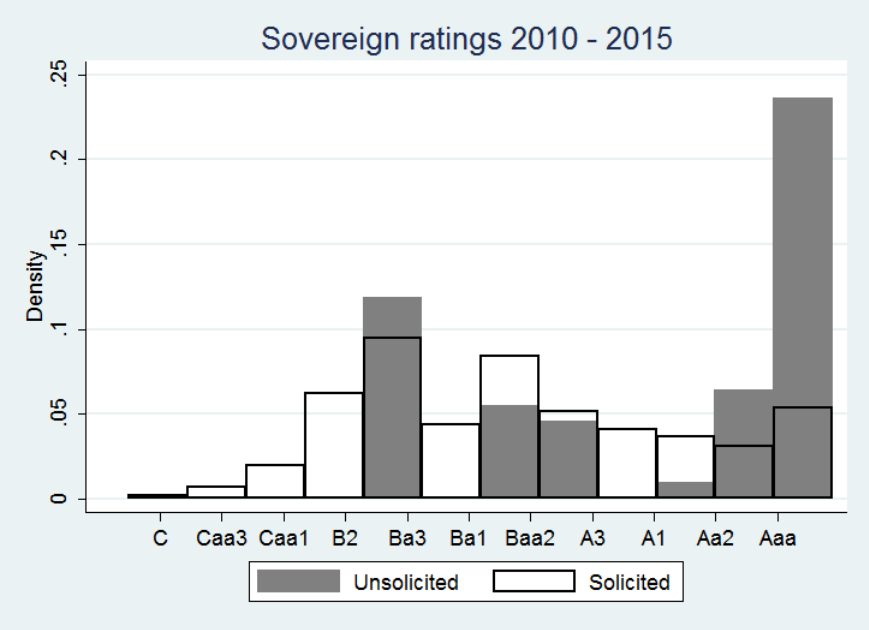


Figure 1: Histogram of solicited versus unsolicited rating grades. Source: Moody's, 2010 -2015.

solicited sovereign ratings is a Baa2 grade while that of unsolicited ratings is on average an A2 grade.[3] A Wilcoxon-Mann-Whitney test of the difference in means is significantly different from zero as can be seen in table 1. The median values are also statistically different. More generally, equality of the distribution functions is rejected at the 99% confidence using a two-sample Kolmogorov-Smirnov test (K-S statistic: 0.4348).

Table 1: Differences between sovereign mean and median grades for solicited and unsolicited ratings. Source: Moody's, 2010 -2015.

	difference in value	t-statistic	p-value
Mean	−3.89	−5.31	0.0000
Median	−8	20.46	0.0000

The fact that unsolicited sovereign ratings are higher on average calls for a model of market self-selection that is able to produce not only a downward bias but also an upward one, like the one I present here.

Credit rating agencies provide as well "ancillary services", a business that has been growing since the late 90s. Ancillary services "comprise market forecasts, estimates of economic

[3]Moody's rating scale is, in decreasing order of credit quality: Aaa, Aa, A, Baa, Ba, B, Caa, Ca, C. Moody's adds numerical modifiers 1, 2, and 3 to each rating grade from Aa through Caa.

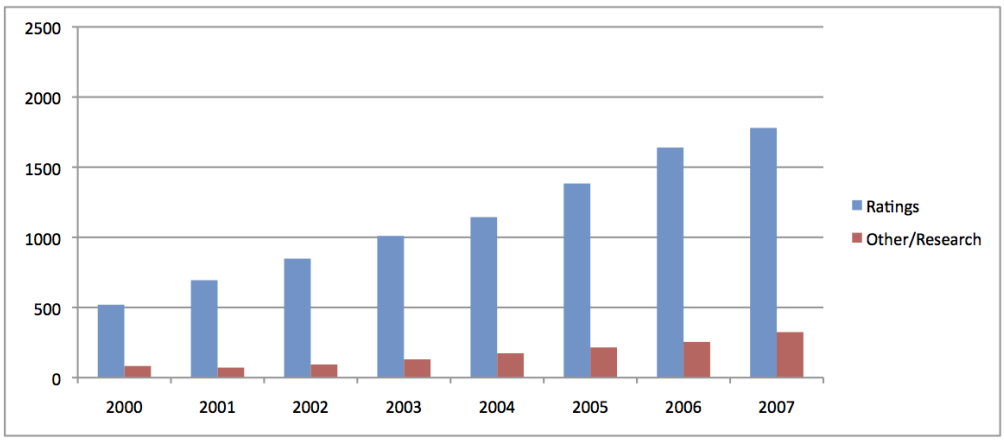


Figure 2: Moody's revenues by line of business from 2000 to 2007.

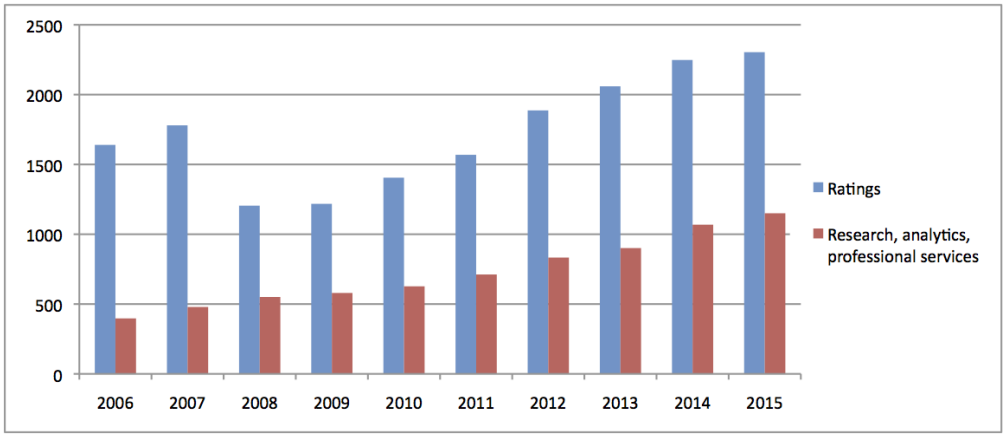


Figure 3: Moody's revenues by line of business from 2006 to 2015.

trends, pricing analysis and other general data analysis as well as related distribution services" (ESMA, 2013). Since 2000 the share of revenues from the rating business went from a maximum of 90% (in 2002) to 70% (in 2015) versus an increasing share of ancillary services that reaches up to 30% (see figures 2 and 3). An example of ancillary service consists in providing the borrower with a forecast of the rating. Moody's Rating Assessment Service was launched in 2000 and charges a company 75.000 euros to know what its credit rating would be if it solicited one (The Economist, 2001). Feedback is provided only to the issuer and assessments are confidential until the issuer decides to announce them publicly. S&P also offers a similar service: the Ratings Evaluation System.

Literature. Fulghieri et al. (2014) introduce the first model of strategic motivation for unsolicited ratings. They see unsolicited ratings as an off-equilibrium threat, which is credible because it shows that the CRA fights the temptation to issue inflated ratings. Byoun (2014) presents a model of ratings where the existence of unsolicited ratings in equilibrium is not

strategically motivated, it is granted by the assumption that the CRA has to produce a rating for each firm. In my model, rating agencies are interested in issuing unsolicited ratings because it improves visibility, allowing the CRA to charge higher fees on solicited ratings.

There is ample empirical evidence regarding the properties of unsolicited ratings (Poon and Firth, 2005; Poon and Chan, 2010; Van Roy, 2013; Bannier et al., 2010; Gan, 2004). None of them studies *sovereign* unsolicited ratings. As we will see below, descriptive statistics evidence indicate that, contrary to what has been found in other markets, unsolicited sovereign ratings have higher grades and are associated with lower bond yields compared to solicited ones. This contrasts with what has been found in the previous literature for banks, corporations and insurance companies (Behr and Guettler, 2008; Byoun, 2014; Klusak et al., 2015).

This paper sheds light on the relationship between different services provided by the rating agency. To the best of my knowledge, this is the first paper that considers the ratings and the ancillary services jointly. The business of ancillary services has received attention from the regulators, who advocated more transparency in order to avoid conflicts of interest.[4] Here I focus on their effect in the selection that arises in the market.

The paper is organized as follows. In the following section I present some stylised facts about the sovereign unsolicited ratings. In section 3, I set up a model of borrowing under incomplete information where the credit rating agencies may issue ratings, solicited as well as unsolicited, and provide ancillary services. I solve for the equilibrium, characterise the equilibrium outcomes and present the relationship to the empirical facts. Section 4 concludes.

2 Stylized facts about sovereign ratings

2.1 Unsolicited sovereign ratings are more frequent than in other markets

Unsolicited ratings are not issued homogeneously across market segments nor across regions. In 2000, the proportion of unsolicited ratings with respect to the total number of outstanding ratings varied between 6% and 27% in industrial countries, depending on rating agency and region (Bannier et al., 2010). In the US, unsolicited ratings are rare. In the European Union they are more numerous, especially in the segment of sovereign and public finance. Table 2 reports the number of ratings issued by each rating agency by solicitation status

[4]Regulation (EC) No 1060/2009 on credit rating agencies, amended by Regulation (EU) No 462/2013 of the European Parliament and of the Council of 21 May 2013.

and for each market segment. In 2012, 12.24% of the sovereign and public finance ratings by the three biggest rating agencies in the EU was unsolicited, while only 4.95% of the corporate ratings, 3.33% of the financial and insurance institutions and 0% of the structured finance ratings (ESMA, 2013). The agencies Moody's and S&P gave in 2012 more unsolicited

		Fitch	Moody's	S&P
Corporate	Solicited	518	760	951
		82.48%	*99.48%*	*99.79%*
	Unsolicited	110	4	2
		17.52%	*0.52%*	*0.21%*
Financials and Insurance	Solicited	597	542	1006
		97.07%	*99.82%*	*94.82%*
	Unsolicited	18	1	55
		2.93%	*0.18%*	*5.18%*
Sovereign and Public Finance	Solicited	296	232	189
		83.38%	*93.93%*	*87.91%*
	Unsolicited	59	15	26
		16.62%	*6.07%*	*12.09%*
Structured Finance	Solicited	4861	4438	4705
		100.00%	*100.00%*	*100.00%*
	Unsolicited	0	0	0
		0.00%	*0.00%*	*0.00%*

Table 2: Ratings by solicitation status for different market segments in the EU in 2012. Source: ESMA.

rating to sovereigns than to other categories and Fitch to both sovereigns and corporates. The majority of the other smaller rating agencies specialize in issuing only solicited or only unsolicited ratings (ESMA, 2013).

For the agency Moody's, the fraction of sovereigns that receive an unsolicited rating are distributed by grade as follows: 10.9% are high grades (investment grade) and 4.15% are low grades (below investment grade) as can be read from table 3.

Table 3: Fraction of sovereigns that receive an unsolicited rating by rating grade (Moody's, 2010-2015).

	Unsolicited	Observations
Grade Baa3 or above	10.9%	412
Grade below Baa3	4.15%	313

2.2 Unsolicited sovereign ratings are higher than solicited ones

In a sample of all the sovereign ratings issued by Moody's between 2010 and 2015,[5] I translated the rating grades into a numerical scale that goes from 1 (grade C) to 21 (grade AAA). If we control for some observable characteristics of the sovereigns (current account, debt over GDP, primary deficit, GDP per capita, inflation, direct investment and a set of regional and year dummies), having an unsolicited rating improves the rating grade by almost one and a half points with respect to a similar country that has paid for its rating. From a rating of Baa2, this would imply an upgrade to A3. The specification is similar to that of Gan (2004) and Van Roy (2013):

$$Rating_{i,t} = X_{i,t}\beta + \delta Solicitation_{i,t} + \epsilon_{i,t} \tag{1}$$

but including time (year) as well as region (country) variation, where *Solicitation* is a dummy variable for the solicitation status that takes value 0 if the rating is solicited and 1 if it is unsolicited. Table 4 presents the estimated coefficient $\hat{\delta}$, which is positive and significant at the 1% level.

The first column does not include fixed effects. The estimated positive effect of receiving on unsolicited rating becomes larger and more significant once you include year fixed effects (column 2), country fixed effects (column 3) or both (column 4). The average rating grade is higher for unsolicited sovereign ratings.

Is this effect homogeneous along the rating scale? Table 5 reports three quantile regressions. The first column refers to the effect of solicitation on the rating grade for the first quartile (0.25) and its effect is the least significant and the smallest. The higher the rating grades (columns 2 and 3), the more sizeable the positive effect of unsolicited ratings.

Let us see which countries are likely to receive unsolicited ratings. The unconditional probability for an individual country of obtaining an unsolicited rating is 7.49% in my sample. It is more likely, though, for countries with a higher rating grade, more outstanding public debt over GDP and a higher GDP per capita. Controlling for other factors, being in the region of Europe or East Asia makes it less likely that a suitable candidate receives an unsolicited rating. This might be due to the fact that there are more countries in those regions that could potentially be candidates.

In order to see whether Moody's changed its criteria for rating countries unsolicitedly over time, I predicted the estimated probability that a country of certain characteristics receives an unsolicited rating for each year between 2010 and 2015.[6] As expected, countries rated unsolicitedly had a higher predicted probability of receiving an unsolicited rating. But

[5]The sample is obtained from reading the internal documents published by Moody's ("Unsolicited Ratings List") from its earliest release in September, 6 2010 to the latest in December 30, 2015.

[6]See appendix A.

Table 4: OLS with robust standard errors

	(1) Rating grade	(2) Rating grade	(3) Rating grade	(4) Rating grade
Solicitation dummy	0.939*	1.489***	0.984**	1.469***
	(0.498)	(0.512)	(0.489)	(0.506)
Current account	0.135***	0.128***	0.134***	0.128***
	(0.0140)	(0.0140)	(0.0139)	(0.0139)
Debt	-0.0177***	-0.0214***	-0.0172***	-0.0207***
	(0.00427)	(0.00437)	(0.00425)	(0.00434)
Primary deficit	-0.211***	-0.196***	-0.209***	-0.194***
	(0.0320)	(0.0294)	(0.0322)	(0.0296)
GDP per capita	0.000152***	0.000143***	0.000151***	0.000143***
	(0.00000924)	(0.00000955)	(0.00000920)	(0.00000956)
Inflation	-0.151***	-0.145***	-0.156***	-0.150***
	(0.0201)	(0.0195)	(0.0221)	(0.0216)
Direct investment	0.136***	0.121***	0.135***	0.119***
	(0.0199)	(0.0215)	(0.0197)	(0.0214)
Region FE	no	yes	no	yes
Time FE	no	no	yes	yes
N	669	669	669	669
R-square	0.676	0.690	0.682	0.695
F	126.0	418.5	72.17	198.9

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

other countries with solicited ratings were just as likely or more to receive an unsolicited rating, for example Austria, Belgium, Norway, Botswana, South Africa and Ghana. You can find the complete list of the sovereign unsolicited ratings in the first column in appendix B. In the second column there is the list of sovereigns with a predicted probability of receiving an unsolicited rating higher than the average predicted probability of the sovereigns in the first column. First, in 2010 and 2011, the profile were top quality sovereign borrowers in Europe. Later on, as the competition across CRAs got increasingly intense and Africa started issuing international debt more frequently, some relatively stable economies in that continent became natural candidates for unsolicited ratings as well.

Table 5: Quantile regressions

	(1)	(2)	(3)
	Rating grade	Rating grade	Rating grade
Solicitation dummy	0.775*	1.371***	1.536***
	(0.409)	(0.461)	(0.451)
Current account	0.109***	0.142***	0.120***
	(0.0134)	(0.0161)	(0.0157)
Debt	-0.0177***	-0.0241***	-0.0225***
	(0.00331)	(0.00370)	(0.00415)
Primary deficit	-0.138***	-0.165***	-0.179***
	(0.0271)	(0.0302)	(0.0245)
GDP per capita	0.000127***	0.000175***	0.000196***
	(0.00000808)	(0.00000725)	(0.00000620)
Inflation	-0.202***	-0.134***	-0.134***
	(0.0139)	(0.0181)	(0.0216)
Direct investment	0.107***	0.155***	0.156***
	(0.0212)	(0.0208)	(0.0215)
Region FE	yes	yes	yes
Time FE	yes	yes	yes
N	669	669	669
Quantile	0.25	0.50	0.75
Residual degree freedom	651	651	651

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.3 Unsolicited sovereign ratings have lower associated debt yields

I merged the sample of Moody's unsolicited ratings between November 2010 and December 2015 with the long-term sovereign yields at the end of the month for the same period. I also have data on the outlook (negative, neutral or positive) at the end of the month. I use the following specification:

$$SovereignYields_{i,t} = X_{i,t}\beta + \lambda Solicitation_{i,t} + u_{i,t} \tag{2}$$

and report the results in table 6. In a linear regression of the yields on the solicitation dummy variable (and additional controls), I find that the unsolicited status of a rating grade represents an average decrease of 3.8 percentage points in the sovereign yields compared to the solicited status. Unsolicited ratings are associated with an improvement in the price of

Table 6: OLS with robust standard errors

	(1) Sovereign yields	(2) Sovereign yields	(3) Sovereign yields
Solicitation dummy	-3.023***	-3.023***	-3.823***
	(0.127)	(0.125)	(0.126)
Rating	-0.314***	-0.379***	-0.745***
	(0.0626)	(0.0623)	(0.198)
Positive outlook	no	-2.600***	-0.223
		(0.398)	(0.195)
Negative outlook	no	1.187***	0.277
		(0.338)	(0.256)
Country FE	yes	yes	yes
Month FE	yes	yes	yes
Country-Year FE	no	no	yes
N	1837	1837	1837
R-square	0.768	0.771	0.923
F	138.8	145.6	717.1

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

debt higher than that of a one point higher rating grade (0.75) or a better outlook (0.22)[7] Thus, the market charges a lower risk premium to bonds from issuers with high unsolicited rating grades than to bonds from issuers with the same solicited grades. For example, a triple A unsolicited borrower pays on average 1.67, whereas a triple A solicited one pays an average yield of 2.43.

How good are the ratings at explaining the sovereign yields? The correlation between sovereign yields and sovereign ratings is -0.69, both for solicited as well as for unsolicited ratings. Year by year the correlation can be found in figure 4 and it is shown to be not significantly different for the groups of solicited and unsolicited ratings. Hence, there is no

[7]The outlook becomes insignificant in my last specification once all controls have been introduced.

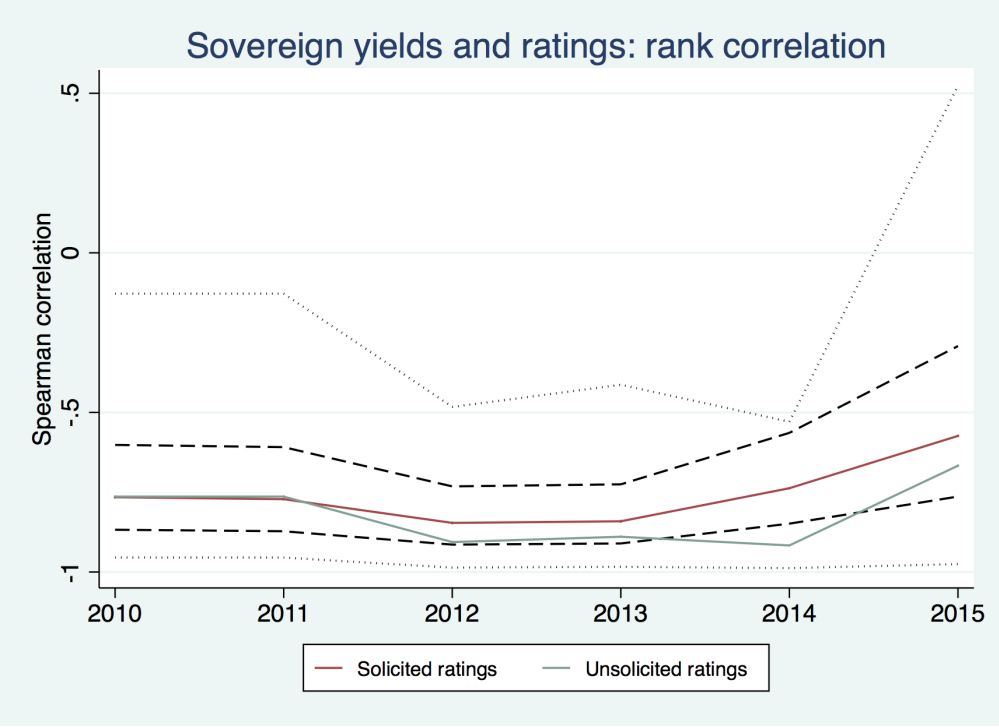


Figure 4: Confidence intervals for the correlation between sovereign yields and ratings by Moody's from 2010 to 2015 separated by solicitation status.

evidence that the rating agencies perform better at predicting the sovereign yields in any particular category.

3 Model

A crucial component of the model will be market selection. I hence need to introduce borrowers' heterogeneity. For simplicity I assume there are only two types of borrowers, one with a higher probability to default than the other. The probability to default is ex-ante not observable. But the CRA can obtain information about it at a cost. This cost can be interpreted as the analyst wage to study the data and produce a rating. The CRA incurs this cost every time they have to come up with a rating, regardless of whether they are compensated for it or not.

Unsolicited ratings are a way to increase the visibility of a rating agency. According to Byoun and Shin (2012),"unsolicited ratings are also considered a means of raising a rating agency's profile in particular countries: that is, rating agencies provide unsolicited ratings to investors in an attempt to gain a competitive advantage over those who do not assign unsolicited rating". As an agency becomes known it will be more likely approached

by some client to request its services. Clearly, borrowers who are unaware of the existence of a particular rating agency are not going to ask for a solicited rating there. Even if a rating agency is known already, producing more ratings or more recent ratings may be a way to let the market know about your technology and advertise your accuracy. A more standard rating is easier for the lenders to interpret and more attractive when trying to attract funds. For instance, the company FCE Bank plc replies to an ESMA call for evidence on the "Competition, choice and conflicts of interest in the credit rating industry" that "in order to protect and provide confidence to our investors, we tend to select the market accepted CRAs." (ESMA, 2015).

In the previous section we saw evidence that 1) in the sovereign market unsolicited ratings are more numerous, 2) unsolicited sovereign ratings have higher grades than solicited sovereign ratings and 3) unsolicited ratings are associated with lower debt yields, that is, sovereigns with unsolicited ratings pay less for issuing debt than others with the same grade but solicited ratings. Current theories about the existence of unsolicited ratings cannot account for these facts. Unsolicited ratings are generally modelled as a punishment in the form of downward biased ratings, which contradicts evidence 2 and 3. Or they can be an option that only some borrowers face: those not confident enough to ask for a rating previously. I present an economic mechanism that may account for these facts by changing two assumptions: the first one is the timing, the CRA chooses whether to assign an unsolicited rating before the borrower decides if it solicits one. The second assumption is about the beliefs in the case of unsolicited ratings: I assume the borrowers do not expect the CRA to give them a bad rating if the CRA knows this information is untrue.

My model gives rise to two possible equilibria as a function of some parameters: one where unsolicited ratings are associated with lower grades and another one where they are associated with higher grades. In what follows, the determinants of each of these equilibria will become clear.

3.1 Basic economic environment

Borrowers can be of two types $i \in \{A, B\}$ with shares θ and $1-\theta$. Each borrower of type i gets indebted for a fixed amount D. The future gross return is $\tilde{R} = R$ with probability λ_i and $\tilde{R} = r$ with probability $1-\lambda_i$, where $R > D > r > 0$. Since the borrower has limited liability, type i's probability of default is $1-\lambda_i$, where $1 \geq \lambda_A > \lambda_B > 0$.

Lenders do not know the borrower's type. They are risk neutral with discount factor β. Lenders compete on debt prices à la Bertrand, making zero expected profits. They charge a price q for lending D, taking into account the expected probability of default, which will be

specified later. For a pair (q, D), the borrower's expected payoff equals $qD + \mathbb{E}_i\{\tilde{R}\} - \lambda_i D$, where $\mathbb{E}_i\{\tilde{R}\} := \lambda_i R + (1 - \lambda_i)r$.

In the economy, there exists a credit rating agency (CRA) which has access to costly private information about the borrower's type. By paying a cost c, the CRA receives the random signal $\sigma = \{H, L\}$: if the country is of type A, the CRA receives the H signal with probability 1 while, if the country is of type B, the H signal is received with probability $p < 1$. The rating grade consists of a truthful report on the signal received and is denoted by $g \in \{H, L\}$.

A borrower can choose to solicit a rating to the agency before issuing debt. The benefit of doing so is that a rating can give information to the market and improve the debt price q that the lenders are willing to offer. The rating agency charges a fee ϕ for issuing solicited ratings.

The CRA can also issue unsolicited ratings. Unsolicited ratings are free of charge. As we will see, the CRA benefits from unsolicited ratings because they affect the fee that can be charged for a rating. I assume that when a CRA issues more ratings (either solicited or unsolicited), it has a higher visibility and/ or improves its bargaining power with respect to the borrower. Therefore, unsolicited ratings allow the agency to charge higher fees for solicited ratings. I assume the following functional form: $\phi(D, \gamma) = \alpha_1 + \alpha_2 \gamma D$. For $\alpha_1, \alpha_2 > 0$ fees are increasing in the amount of debt issued and in the fraction of unsolicited ratings assigned.

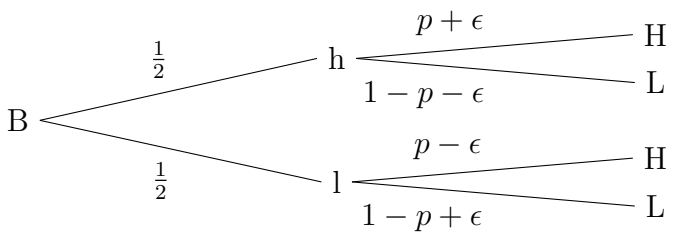
The CRA also provides ancillary services for a fee χ. Ancillary services give the borrower the opportunity to learn about the CRA's private signal and to veto the revelation of that information.[8] The rating assesment $m = \{h, l\}$ is an imperfect forecast of the rating signal g and it is summarized in figure 5. An assesment $m = h$ is received with probability $\frac{1}{2}$ and $m = l$ with probability $\frac{1}{2}$. Conditional on receiving a positive assesment, type B receives a rating grade H with probability $p + \epsilon$, and L with the complementary probability $1 - p - \epsilon$, whereas conditional on a negative assesment a rating grade H is given with probability $p - \epsilon$ and L with probability $1 - p + \epsilon$. There is no uncertainty about type A rating, it receives H with probability 1. Assume $\epsilon > 0$ and $\epsilon < 1 - p$. These probabilities can be seen as posteriors and the technology of information acquisition is the same in both cases.

Additionally, in the ancillary services contract, the agency commits not to issue an unsolicited rating if the borrower does not solicit one.

Assume that a fraction ξ of borrowers do not enter the game; they access the market

[8] Ancillary services can play several roles: for instance, reducing the uncertainty about the outcome of the rating process for the borrowers or improving the transmission of information between the borrower and the rating agency. On top of that, confidentiality is an essential element of some of these services that are recently provided by the CRAs.

Figure 5: Ancillary services assesment.



issuing unrated debt. This assumption guarantees that the $g = L$ rating, which is fully revealing of a B type, is perceived to be worse than no rating $g = 0$. Having a low rating or being downgraded is known to have an effect in the price of debt. It is reasonable that borrowers expect the market to judge them more harshly if they have been given a bad rating than if they have none. In the absence of bad news they could expect the lenders to have some uncertainty about their credit standing, which is even more likely to happen in the case where more types could be mistaken for one another. As unrated countries are a pool of different borrowers that do not access the rating services, being unrated could be perceived to be better than having a low rating.[9]

The timing is the following:

1. In stage $t = 0$, the borrower decides whether to buy ancillary services at cost χ. Denote this decision by $a \in \{0, 1\}$.

2. If the borrower is a client of ancillary services, in stage $t = 1$, it receives a non-binding assessment about the rating grade, which can be $m = h$ or $m = l$. In stage $t = 2$, borrowers choose whether to solicit and pay the fee $\phi(D, \gamma)$ for a rating: $s = \{0, 1\}$. Denote as $g = 0$ the case in which the borrower remains unrated.

3. If the borrower is not a client of ancillary services, in stage $t = 1$, the rating agency may issue an unsolicited rating. $\gamma \in [0, 1]$ represents the fraction of unsolicited ratings issued. After deciding to issue an unsolicited rating, the signal $\sigma = \{H, L\}$ is received. In stage $t = 2$, borrowers that did not receive an unsolicited rating have the option to solicit one, $s = \{0, 1\}$. Note that a borrower cannot have both a solicited and unsolicited rating.

[9] As a matter of fact, there is a small but growing number of borrowers which decide to issue debt in the international debt market without a rating. They have accounted for about 10 per cent of the European corporate bond market in recent years and usually they could be classified as investment, or near-investment grade (Bolger and Wigglesworth, 2014).

The lenders observe the choices of the borrower and those of the rating agency, except for the existence of ancillary services, which is kept confidential between the borrower and the CRA. To sum up, the borrower can have a rating, $g = H$ or $g = L$, or none, $g = 0$. Ratings can be either solicited or unsolicited but not both of them.

3.2 CRA problem

The CRA takes two actions: in $t = 1$ it decides the fraction γ of unsolicited rating to non-clients of ancillary services[10] and, in $t = 2$, it issues a solicited rating if it has been asked for one. The truth-telling assumption implies that the grade report will be either the signal the CRA received or none. Denote the rating grade report $g(a, u, s, \sigma)$, where the first element corresponds to the choice of ancillary services, the second represents the existence of an unsolicited rating, the third of a solicited one and the last element is the signal about the creditworthiness of the borrower available to the CRA. Depending on those elements, the rule for assigning a rating grade is the following:

$$g^*(1, 0, 1, \sigma) = \sigma,\ g^*(1, 0, 0, \sigma) = 0, \tag{3}$$

$$g^*(0, 0, 1, \sigma) = \sigma,\ g^*(0, 1, 0, \sigma) = \sigma \tag{4}$$

$$\text{and } g^*(0, 0, 0, \sigma) = 0. \tag{5}$$

When the borrower is a client of ancillary services, $a = 1$, it may request a rating or not, in which case it won't receive an unsolicited one. If the borrower is not a client, $a = 0$, it may request a rating and, if not, it may receive on unsolicited one or it may also be unrated.

In $t = 1$ the CRA problem is the following:

$$\max_{\gamma} -\gamma c + \left[(1 - \gamma) f^*(\gamma) \left(\phi(D, \gamma) - c\right)\right], \tag{6}$$

where $f^*(\gamma)$ is the fraction of borrowers that solicit a rating in equilibrium. The CRA chooses the proportion of unsolicited ratings taking into account that each rating has a cost c today and it also has an effect in the next stage: on the one hand, it crowds out solicited ratings, as a borrower cannot have both a solicited and unsolicited rating, hence only $1-\gamma$ borrowers are susceptible to solicit a rating afterwards; on the other hand, it increases the fees that can be charged for those solicited ratings. Therefore, γ^* is, as well, the probability that a non-client of ancillary services gets an unsolicited rating.

[10] Recall that clients of ancillary services do not receive unsolicited ratings.

3.3 Lenders' problem

Lenders lend the amount qD to the borrower and receive D at the end of the game if there is no default. In case of default, there is no partial repayment. The lender profit function is:

$$\Pi = -qD + \beta \left[\mu\lambda_A D + (1-\mu)\lambda_B D\right], \tag{7}$$

where $\mu = \mu(s, g)$ are the lenders' beliefs that the borrower is of type A. Beliefs depend on what the lender observes about the borrowers creditworthiness: the solicitation statute and the rating grade. As a result of imposing the zero-profit condition, the price function satisfies:

$$q(\mu) = \beta[\mu\lambda_A + (1-\mu)\lambda_B]. \tag{8}$$

The value $\mu(0, 0)$ represents the lenders' beliefs when they see no rating for some borrower, $\mu(0, H)$ and $\mu(0, L)$ the lenders see an unsolicited rating of H or L, respectively.

3.4 Borrower's problem

The borrower faces two problems: whether to buy ancillary services at $t = 0$ and whether to solicit a rating at $t = 2$. The borrower's payoff, depending on its rating, is the following:

- If the borrower buys ancillary services and it also solicits a rating: $q(\mu)D + \lambda_i(R - D) + (1 - \lambda_i)r - \phi(D, \gamma) - \chi$, where the first term is the amount of borrowing at price $q(\mu) = q(1, g)$, the second and third terms are the net revenues weighted by the repayment probabilities and the last two terms are the fee for solicitation and ancillary services, respectively.

- If the borrower solicits a rating but does not buy ancillary services, it saves on the amount of ancillary fees: $q(1, g)D + \lambda_i(R - D) + (1 - \lambda_i)r - \phi(D, \gamma)$.

- A borrower that does not buy ancillary services may receive an unsolicited rating with an associated payoff of $q(0, g)D + \lambda_i(R - D) + (1 - \lambda_i)r$, where the price of debt is $q(0, g)$ and the borrower does not incur in any fees.

- Finally, if the borrower is unrated the payoff equals $q(0, 0)D + \lambda_i(R - D) + (1 - \lambda_i)r$ if it did not buy ancillary services or $q(0, 0)D + \lambda_i(R - D) + (1 - \lambda_i)r - \chi$ if it did.

3.5 Equilibrium

I solve using the Perfect Bayesian Equilibrium.

Definition 3.1. *Given the CRA rule of $g^*(a, u, s, \sigma)$, a symmetric equilibrium is a γ^*, a strategy for the borrower:*

$$\{a^*, s^*\} : \{A, B\} \to \{0, 1\} \times \{0, 1\}, \tag{9}$$

where $a^*(i)$ is the choice of ancillary services and $s^*(i, a(i))$ is the rating solicitation, a strategy for the lender about the debt price $q^*(s, g) : \{0, 1\} \times \{H, L, 0\} \to \mathbb{R}_+$ and a system of beliefs $\mu^*(s, g) : \{0, 1\} \times \{H, L, 0\} \to [0, 1]$ about the borrower being type A, such that:

- *γ^* maximises the CRA profit function (6) and $f^*(\gamma)$ is consistent with the borrower's strategy.*
- *The strategy profile is sequentially rational given the beliefs and γ^*.*
- *The beliefs are consistent with Bayes' rule whenever possible.*

3.6 Model without ancillary services

Let us first solve the model without ancillary services as a benchmark. The game starts at $t = 1$. All the other modeling assumptions stay the same.

Proposition 3.1. *A rule of $g^*(u, s, \sigma)$: $g^*(0, 1, \sigma) = \sigma$, $g^*(1, 0, \sigma) = \sigma$ and $g^*(0, 0, \sigma) = 0$, the strategies $s^*(A) = 1, s^*(B) = 0$, $q^*(\mu) = \mu\lambda_A + (1 - \mu)\lambda_B$ and $\gamma^* = \frac{(1-\theta)c+\theta\alpha_1}{-2\theta\alpha_2 D} + \frac{1}{2}$ constitute an equilibrium of the model without ancillary services given the following beliefs $\mu(s, g)$: $\mu(s, L) = 0 \,\forall\, s, \mu(1, H) = 1$,*

$$\mu(0, H) = \begin{cases} 1 & w.\ prob.\ \frac{\theta}{\theta+(1-\theta)p} \\ 0 & w.\ prob.\ \frac{(1-\theta)p}{\theta+(1-\theta)p} \end{cases}$$

and

$$\mu(0, 0) = \begin{cases} 1 & w.\ prob.\ \frac{\theta\xi}{\theta\xi+(1-\theta)(1+\gamma(\xi-1))} \\ 0 & w.\ prob.\ \frac{(1-\theta)(1+\gamma(\xi-1))}{\theta\xi+(1-\theta)(1+\gamma(\xi-1))}. \end{cases}$$

The CRA assigns a proportion γ^* of unsolicited ratings to both type A and type B borrowers in order to maximise its profit function (6) in $t = 1$:

$$\max_{\gamma} -\gamma c + (1 - \gamma)\theta \left[\phi(D, \gamma) - c\right].$$

Substituting the functional form of $\phi(D, \gamma)$ and solving the maximization problem, we obtain the first order condition:

$$-c - \theta(\alpha_1 + \alpha_2 \gamma D) + \theta(1-\gamma)\alpha_2 D + \theta c = 0.$$

Rearranging we find an expression for the optimal fraction of unsolicited ratings that the CRA issues:

$$\gamma^* = \frac{(1-\theta)c + \theta\alpha_1}{-2\theta\alpha_2 D} + \frac{1}{2}. \tag{10}$$

Since $\gamma'(D) > 0$ if $\alpha_1 > c$, γ^* is increasing in the amount of debt.

For condition $\underline{\phi} > \phi > \bar{\phi}$[11] type A prefers to solicit a rating rather than remaining unrated, if they are not given an unsolicited one, while type B does not. Conditions state that ϕ in equilibrium has to stay within some upper and lower bounds: the bounds depend on $D, \gamma^*, \theta, \lambda_A$ and λ_B. A fee too high would discourage even the best borrowers to ask for a rating.

Type A can have either a solicited or unsolicited H rating and a fraction ξ is unrated by assumption. If type A were allowed to solicit a rating after an unsolicited one they may choose to do so. The reason is the price of debt is better for solicited ratings for the same H grade. We simplify away from this possibility but this behaviour is something we might observe. Type B can have an H unsolicited rating, L unsolicited rating or no rating. There are no grade L solicited ratings. Thus, unsolicited ratings have lower grades on average.

Type A knows that it is more likely to receive an H rating, so it has an incentive to pay the fee for a solicited rating. Type B, on the contrary, has a lower probability p to receive an H rating and a high probability to receive an L rating, which bears a higher risk premium than an absence of rating. The fact that higher quality borrowers are more inclined to get rated is a well-known result in the literature (Lizzeri, 1999; Mathis et al., 2009; Fulghieri et al., 2014).

3.7 Introducing ancillary services

Proposition 3.2. *For $g^*(a, u, s, \sigma)$ given by equations (3)-(5), the strategies $a^*(A) = 0, a^*(B) = 1, s^*(A, 0) = 1, s^*(B, 0) = 0, s^*(A, 1) = 1$, $s^*(B, 1) = 1$ if $m = h$ and 0 if $m = l$, $q^*(\mu) = \mu\lambda_A + (1-\mu)\lambda_B$ and γ^* that solves problem (6) constitute an equilibrium of the*

[11] See Appendix C for a proof.

model given the following beliefs: $\mu(0,H)=1, \mu(0,L)=0, \mu(1,L)=0$,

$$\mu(1,H)=\begin{cases}1 & w.\ prob.\ \frac{2\theta(1-\gamma)}{2\theta(1-\gamma)+(1-\theta)(p+\epsilon)}\\ 0 & w.\ prob.\ \frac{(1-\theta)(p+\epsilon)}{2\theta(1-\gamma)+(1-\theta)(p+\epsilon)}\end{cases}$$

and

$$\mu(0,0)=\begin{cases}1 & w.\ prob.\ \frac{2\theta\xi}{2\theta\xi+(1-\theta)(\xi+1)}\\ 0 & w.\ prob.\ \frac{(1-\theta)(\xi+1)}{2\theta\xi+(1-\theta)(\xi+1)}\end{cases}$$

if $\gamma > \bar{\gamma}$.

The CRA assigns a proportion γ^* of unsolicited H ratings to type A borrowers. Type B borrowers enter a contract of ancillary services and avoid receiving unsolicited ratings. They can either have a solicited H or L rating, after having observed the assessment $m=h$, or no rating, after having observed the assessment $m=l$. A fraction ξ of borrowers is unrated by assumption. Type A borrowers who are neither unrated nor received an unsolicited rating, solicit and receive an H rating. There are no grade L unsolicited ratings, as the type B borrowers that would be subject to receiving one prefer to pay for ancillary services and veto that possibility. Hence, unsolicited ratings have higher grades on average. There are two thresholds values $\bar{\phi}$ and $\underline{\phi}$[12] such that: for $\phi > \underline{\phi}$ and $\phi < \bar{\phi}$, $s^*(A,a)=1\,\forall a$ and $s^*(B,0)=0$, $s^*(B,1)=1$ if $m=h$ and 0 if $m=l$.

Type A prefers to solicit a rating whenever $\phi < \bar{\phi}$, whether they are clients of ancillary services or not. Their incentives to solicit are high, because the probability of getting a high rating is large, as long as the price of ratings is sufficiently low. Type B, on the contrary, prefers not to solicit a rating unless they are given a strong signal, a positive assessment, that the rating will be high. That is, if the fees are high enough with respect to the probability p of being given an H rating.

The CRA problem (6) can be rewritten in the following way:

$$\max_{\gamma} -\gamma c + (1-\gamma)\theta\left[\phi(D,\gamma)-c\right] + \frac{1}{2}(1-\theta)\left[\phi(D,\gamma)-c\right]. \tag{11}$$

Plugging in the functional form of $\phi(D,\gamma)$ and solving for γ:

$$\gamma^* = \frac{(1-\theta)c+\theta\alpha_1}{-2\theta\alpha_2 D} + \frac{1}{2}\left(\frac{1}{2}+\frac{1}{2\theta}\right), \tag{12}$$

[12]The thresholds depend on the parameters of the model and a formal derivation can be found in appendix D.

where the first two terms coincide with the expression for the optimal fraction of unsolicited ratings in the model without ancillary services and the term in parenthesis, which is > 1 for $0 > \theta > 1$, represents the additional incentive to issue unsolicited ratings due to the gains coming from the clients of ancillary services.

For $a^*(B) = 1$,

Proposition 3.3. *Provided γ is high enough, type B prefers to buy ancillary services for a fee χ and obtain a rating H with probability p and no rating $g = 0$ with probability $1-p$ than risk getting an unsolicited H rating with probability γp and L with probability $\gamma(1-p)$.*

The existence of this equilibrium depends on the value of γ:

$$\gamma > \bar{\gamma} := \frac{\beta G(\theta, \xi, \lambda_A, \lambda_B) + \frac{\alpha_1}{2} + \chi}{2\beta G(\theta, \xi, \lambda_A, \lambda_B) - \alpha_2 D}. \tag{13}$$

where $G(\theta, \xi, \lambda_A, \lambda_B) = \frac{2\theta\xi\lambda_A + (1-\theta)(\xi+1)\lambda_B}{2\theta\xi + (1-\theta)(\xi+1)}$. Note that $a^*(A) = 0$ is always true[13]. If type A does not ask for ancillary services it might get an unsolicited H rating or a solicited H rating. With ancillary services the outcome is always a solicited H rating but at the extra cost of having to pay the fee χ.

In this set-up, unsolicited H ratings are assigned only to A types, therefore they are fully revealing of the high quality type. This confirms equilibrium beliefs in proposition 3.2. Off-equilibrium beliefs $\mu(0, L)$ are set equal to 0.

Since unsolicited H ratings are assigned only to A types but solicited H ratings can be assigned to A and B types, we expect to see a market premium in the price of debt of high unsolicited ratings with respect to solicited.

Note that γ is a choice of the rating agency that is described by the expression (12). When γ is low, type B does not choose ancillary services and the equilibrium outcome is similar to the one described in the solution to the model without ancillary services.

Proposition 3.4. *For $g^*(a, u, s, \sigma)$ given by equations (3)-(5), the strategies $a^*(A) = 0, a^*(B) = 0, s^*(A, 0) = 1, s^*(B, 0) = 0, s^*(A, 1) = 1$, $s^*(B, 1) = 1$ if $m = h$ and 0 if $m = l$, $q^*(\mu) = \mu\lambda_A + (1-\mu)\lambda_B$ and γ^* that solves problem (6) constitute an equilibrium of the model given the following beliefs: $\mu(s, g)$: $\mu(s, L) = 0 \,\forall\, s, \mu(1, H) = 1$,*

$$\mu(0, H) = \begin{cases} 1 & w.\ prob.\ \frac{\theta}{\theta + (1-\theta)p} \\ 0 & w.\ prob.\ \frac{(1-\theta)p}{\theta + (1-\theta)p} \end{cases}$$

[13]For $a^*(A) = 0$: $\gamma q(0, H)D + (1-\gamma)\left[q(1, H)D - \phi(\gamma, D)\right] > \frac{1}{2}q(1, H)D + \frac{1}{2}q(1, H)D - \phi(\gamma, D) - \chi$. Since $q(0, H) > q(1, H)$, the statement is always true.

and

$$\mu(0,0) = \begin{cases} 1 & w.\ prob.\ \frac{\theta\xi}{\theta\xi+(1-\theta)(1+\gamma(\xi-1))} \\ 0 & w.\ prob.\ \frac{(1-\theta)(1+\gamma(\xi-1))}{\theta\xi+(1-\theta)(1+\gamma(\xi-1))} \end{cases}$$

if $\gamma \leq \bar{\gamma}$.

Thus, all grade H solicited ratings are assigned to type A borrowers whereas grade H unsolicited ratings can be given to type A or B with different probabilities. Grade L unsolicited ratings are assigned to type B borrowers. Finally, unrated borrowers can be either type A or B. This confirms equilibrium beliefs in proposition 3.4. Off-equilibrium beliefs $\mu(1, L)$ are free to be $[0, 1]$, in this case, they are equal to 0.

3.8 Comparative statics

Some parameters affect the determination of the equilibrium.

- The amount of debt issued by a given borrower category or in a given market segment (D). D affects the fraction of borrowers susceptible to receive an unsolicited rating: since $\gamma'(D) > 0$, the higher the amount of debt in a given market or whenever the borrowers issue more debt, the more incentives the CRA has to assign unsolicited ratings. This is because the benefits from increased fees in the future - due to the high debt - more than compensate for the costs of issuing unsolicitedly. The CRA has incentives to increase their revenues when those are the largest, as it is the case when there is a lot of debt to intermediate.

  Suppose there are two equilibrium probabilities of issuing an unsolicited rating, γ_1^* and γ_2^*, where $\gamma_1^* < \bar{\gamma} < \gamma_2^*$. Recall that $\bar{\gamma}$ is the threshold of γ that makes type B want to buy ancillary services as defined in equation (13). An increase from γ_1^* to γ_2^* makes type B willing to buy ancillary services in order to avoid a more likely unsolicited rating. Therefore, the equilibrium changes from one without equilibrium ancillary services and lower grades unsolicited ratings to one with equilibrium ancillary services and higher grades unsolicited ratings.

- The ex-ante market perception about the creditworthiness of a borrower (θ). θ affects the conditions on the maximum and minimum levels of ϕ that allow to sustain a given equilibrium. A higher θ provides more incentives for B to ask for ancillary services but also more incentives for A to solicit a rating since both $q(0,0)$ and $q(1,H)$ increase but $q(0,H)$ does not change. Hence, it favours the equilibrium with ancillary services. On

the contrary, a lower θ favours the equilibrium without ancillary services because the worsening of the unrated pool makes it less attractive to be a part of it.

- The parameters governing the fixed part (α_1) and the variable part (α_2) of the CRA's rating fees.
  $\gamma'(\alpha_2) > 0$, hence, an increase in α_2 makes γ higher and it is more likely that there is an equilibrium with ancillary services. α_2 captures the steepness in which unsolicited ratings allow you to charge more fees per unit of debt. Hence, it works very similarly to an increase in γ:

$$\phi(\alpha_1, \alpha_2, D, \gamma) = \alpha_1 + \alpha_2 \gamma D. \tag{14}$$

  α_2 can be interpreted as the bargaining power or the market share of the CRA. If they are in a better position to extract more fees per unit of debt in one market; it is reasonable that they want to take advantage of that by increasing their presence and maximising revenues.

  α_1 is the fixed part of the CRA compensation, irrespective of debt and market position. You can think of it as the minimum amount they require to rate a borrower no matter what the circumstances. It might not compensate the CRA to issue a rating if they are paid below a certain compensation. Condition (10) tells us that α_1 has to be higher than the cost of issuing a rating for $\gamma'(D) > 0$. I.e. the fixed part of the rating fees has to compensate for the fixed costs of issuing a rating.

3.9 Relationship with the data

Higher average debt and high α_2 give incentives to the CRA to assign more unsolicited ratings. In the equilibrium with ancillary services, the proportion of unsolicited ratings, γ^*, is higher, hence, the percentage of type A borrowers that get an unsolicited rating is higher. Moreover, the percentage of unsolicited ratings over total ratings, $\frac{\theta\gamma}{\theta+(1-\theta\frac{1}{2})}$ is higher than in the equilibrium with unsolicited ratings, $\frac{\gamma}{\theta+(1-\theta)\gamma}$, as long as there is not a large number of type B firms: $\gamma < \frac{\theta(1-\theta)}{2(1-\theta-\theta^2)}$. We have seen that unsolicited ratings are frequent among sovereign ratings and they are mostly high rating grades (stylised facts 2.1 and 2.2).

The equilibrium with a higher probability of unsolicited ratings features higher unsolicited rating grades thanks to the opt out option provided by ancillary services (see figure 6). In the equilibrium without ancillary services (low probability of unsolicited ratings γ^*), unsolicited ratings are $g = H$ and $g = L$ (shaded areas) while in the equilibrium with ancillary services (with high probability of unsolicited ratings γ^*) they are $g = H$. Hence, in the latter equilibrium unsolicited ratings are higher on average than solicited ones. But this is not

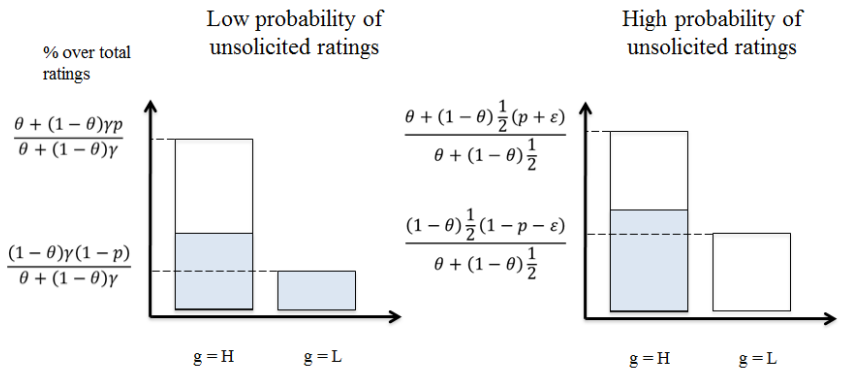


Figure 6: Percentage of solicited and unsolicited ratings.

necessarily true for the other equilibrium. This explains $\delta > 0$ in the regression of sovereign rating grades on solicitation status (table 4).[14]

Conditional on the rating, unsolicited ratings are associated with higher or lower yields depending on the equilibrium. In the equilibrium with ancillary services, $q(0,H)-q(1,H) > 0$ and $q(0,L)-q(1,L) = 0$, hence, unsolicited ratings are associated with lower yields whereas in the equilibrium without, $q(0,H)-q(1,H) < 0$ and $q(0,L)-q(1,L) = 0$, they are associated with higher yields. High unsolicited ratings are associated with a higher $q(0,H)$ because they reveal a type A perfectly (type B chooses to buy ancillary services). This result is in line with $\delta < 0$ in the regression of sovereign yields on solicitation status (table 6).

4 Conclusion

To what extent rating agencies strategically downgrade their unsolicited ratings? The answer to this question is relevant for policy because it matters to determine if the rating agencies may have misbehaved. In this paper I propose a model that assumes away strategic motivations for unsolicited ratings by assuming true-telling on the part of the CRA. The degree of market selection in equilibrium depends on the market size and other market characteristics. The model is, hence, able to explain both the downward bias in unsolicited ratings for certain categories of borrowers (banks, insurance, corporates) as well as the upward bias for sovereign borrowers.

The equilibrium with positive selection on unsolicited ratings is generated thanks to the possibility to enter a private contract with the CRA with a confidentiality clause (e.g. ancillary services). This also allows us to explore in which circumstances the value of opacity

[14]This effect would disappear if we could control perfectly for the type, which we assume we cannot do here since it is private information.

for some borrowers can be marketed by the CRAs. When the rating agencies cater to both the borrowers that have incentives to be transparent as well as those that prefer opacity, they still provide the market with valuable information but the amount of information might be biased towards a particular group of borrowers.

An extended version of the model presented in this paper, properly calibrated, could be able to deliver a useful benchmark for the downward natural bias as a function of the characteristics of the market under study. Identifying the "natural size" of the market selection bias would help to detect the presence of strategic motivation and, hence, inform policy intervention.

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APPENDIX

A Probit models for years 2010 - 2015

Probit models for the probability of having an unsolicited rating given the rating grade, the level of debt over GDP, GDPpc and regional fixed effects for each year between 2010 and 2015.

Table 7: Probit model

	Unsolicited rating					
	2010	2011	2012	2013	2014	2015
Rating grade	0.430	0.397*	0.185**	0.162**	0.174**	0.146*
	(0.287)	(0.204)	(0.0809)	(0.0759)	(0.0815)	(0.0768)
Debt	0.0411*	0.0491**	0.0312**	0.0267**	0.0270**	0.0212**
	(0.0226)	(0.0241)	(0.0139)	(0.0118)	(0.0117)	(0.00931)
GDPpc	0.0000414	0.0000453*	0.0000116	0.00000924	0.0000112	0.00000978
	(0.0000258)	(0.0000267)	(0.0000186)	(0.0000166)	(0.0000177)	(0.0000154)
Geographic dummies	yes	yes	yes	yes	yes	yes
N	93	95	99	104	107	120
r2_p	0.593	0.634	0.481	0.445	0.430	0.357
chi2	32.37	34.82	29.04	31.26	30.48	26.28

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

B List of sovereigns rated unsolicitedly and comparable sovereigns

C Equilibrium conditions in the model without ancillary services

According to the beliefs, the lenders' price function is the following:

$$q(s,\sigma) = \begin{cases} q(0,0) = \beta\left[\frac{\theta\xi\lambda_A+(1-\theta)(1+\gamma^*(\xi-1))\lambda_B}{\theta\xi+(1-\theta)(1+\gamma^*(\xi-1))}\right] \\ q(0,H) = \beta\left[\frac{\theta\lambda_A+(1-\theta)p\lambda_B}{\theta+(1-\theta)p}\right] \\ q(0,L) = \beta\lambda_B \\ q(1,H) = \beta\lambda_A \\ q(1,L) = \beta\lambda_B. \end{cases} \tag{15}$$

The condition for $s^*(A) = 1$ is $q(1,H)D + \lambda_A(R-D) + (1-\lambda_A)r - \phi(D,\gamma) > q(0,0)D + \lambda_A(R-D) + (1-\lambda_A)r$, that is, the payoff for soliciting and obtaining a rating H with probability 1 for a fee $\phi(D,\gamma)$ is higher than the payoff of remaining without a rating. Substituting the expressions for $q(\cdot)$ from (15), we obtain:

$$\phi(D,\gamma^*) < \beta\left[\left(1 - \frac{\theta\xi}{\theta\xi + (1-\theta)\left(1+\gamma^*(\xi-1)\right)}\right)\lambda_A - \frac{(1-\theta)\left(1+\gamma^*(\xi-1)\right)}{\theta\xi + (1-\theta)\left(1+\gamma^*(\xi-1)\right)}\lambda_B\right]D.$$

On the other hand, for $s^*(B) = 0$, paying the fee to solicit a rating, which is H with a probability p and L with a probability $1-p$, is not worth for type B: $q(0,0)D + \lambda_B(R-D) + (1-\lambda_B)r > p\left[q(1,H)D + \lambda_B(R-D) + (1-\lambda_B)r\right] + (1-p)\left[q(1,L)D + \lambda_B(R-D) + (1-\lambda_B)r\right] - \phi(D,\gamma)$. Substituting and rearranging, we obtain the following condition:

$$\phi(D,\gamma^*) > \beta\left[\left(p - \frac{\theta\xi}{\theta\xi + (1-\theta)\left(1+\gamma^*(\xi-1)\right)}\right)\lambda_A + \left((1-p) - \frac{(1-\theta)\left(1+\gamma^*(\xi-1)\right)}{\theta\xi + (1-\theta)\left(1+\gamma^*(\xi-1)\right)}\right)\lambda_B\right]D$$

The two conditions verify the proposed equilibrium choices $s^*(A) = 1$ and $s^*(B) = 0$. This confirms the beliefs in equilibrium and off-equilibrium beliefs $\mu(1,L)$ are free to be set arbitrarily.

	Unsolicited		Solicited	
2010	France	Aaa	Austria	Aaa
	Germany	Aaa	Belgium	Aa1
	Italy	Aa2	Norway	Aaa
	Luxembourg	Aaa		
	Mauritius	Baa2		
	Netherlands	Aaa		
	Switzerland	Aaa		
	United Kingdom	Aaa		
2011	France	Aaa	Austria	Aaa
	Germany	Aaa	Belgium	Aa1
	Italy	Aa3		
	Luxembourg	Aaa		
	Mauritius	Baa2		
	Netherlands	Aaa		
	Switzerland	Aaa		
	United Kingdom	Aaa		
2012	France	Aaa	Austria	Aaa
	Germany	Aaa	Belgium	Aa3
	Italy	Baa1	Botswana	A2
	Kenya	B1	South Africa	A3
	Mauritius	Baa1		
	Netherlands	Aaa		
	Switzerland	Aaa		
	United Kingdom	Aaa		
	Zambia	B1		
2013	France	Aa1	Austria	Aaa
	Germany	Aaa	Belgium	Aa3
	Italy	Baa2	Botswana	A2
	Kenya	B1	Ghana	B1
	Mauritius	Baa1	South Africa	Baa1
	Mozambique	B1		
	Netherlands	Aaa		
	Switzerland	Aaa		
	Uganda	B1		
	United Kingdom	Aa1		
	Zambia	B1		
2014	France	Aa1	Austria	Aaa
	Germany	Aaa	Belgium	Aa3
	Italy	Baa2	Botswana	A2
	Kenya	B1	Ghana	B2
	Mauritius	Baa1	South Africa	Baa1
	Mozambique	B1		
	Netherlands	Aaa		
	Switzerland	Aaa		
	Uganda	B1		
	United Kingdom	Aa1		
	Zambia	B1		
2015	Bahrain	Baa3	Austria	Aaa
	France	Aa1	Belgium	Aa3
	Germany	Aaa	Botswana	A2
	Italy	Baa2	South Africa	Baa2
	Kenya	B1		
	Mauritius	Baa1		
	Netherlands	Aaa		
	Switzerland	Aaa		
	Uganda	B1		
	United Kingdom	Aa1		
	Zambia	B1		

D Equilibrium conditions in the model with ancillary services

According to the beliefs, the lenders' price function is the following:

$$q(s,g) = \begin{cases} q(0,0) = \beta\left[\frac{2\theta\xi\lambda_A+(1-\theta)(\xi+1)\lambda_B}{2\theta\xi+(1-\theta)(\xi+1)}\right] \\ q(0,H) = \beta\lambda_A \\ q(0,L) = \beta\lambda_B \\ q(1,H) = \beta\left[\frac{2\theta(1-\xi)(1-\gamma)\lambda_A+(1-\theta)(1-\xi)(p+\epsilon)\lambda_B}{(1-\xi)[2\theta(1-\gamma)+(1-\theta)(p+\epsilon)]}\right] \\ q(1,L) = \beta\lambda_B. \end{cases} \tag{16}$$

The condition for $s^*(A,0)=1$, under such beliefs, is the following: $q(1,H)D+\lambda_A(R-D)+(1-\lambda_A)r-\phi(D,\gamma) > q(0,0)D+\lambda_A(R-D)+(1-\lambda_A)r$. Substituting the expressions for $q(\cdot)$ from (16), we obtain:

$$\phi(D,\gamma^*) < \beta\left[\frac{2\theta(1-\xi)(1-\gamma^*)\lambda_A+(1-\theta)(1-\xi)(p+\epsilon)\lambda_B}{(1-\xi)\left[2\theta(1-\gamma^*)+(1-\theta)(p+\epsilon)\right]} - \frac{2\theta\xi\lambda_A+(1-\theta)(\xi+1)\lambda_B}{2\theta\xi+(1-\theta)(\xi+1)}\right]D. \tag{17}$$

The condition above is the same to guarantee $s^*(A,1)=1$, no matter whether the assessment is $m=h$ or $m=l$. Moreover, the condition for $s^*(B,1)=1$ if $m=h$ is: $(p+\epsilon)q(1,H)D+(1-p-\epsilon)q(1,L)D+\lambda_A(R-D)+(1-\lambda_A)r-\phi(D,\gamma) > q(0,0)D+\lambda_A(R-D)+(1-\lambda_A)r$. Thus,

$$\phi(D,\gamma^*) < \beta\Bigg[(p+\epsilon)\frac{2\theta(1-\xi)(1-\gamma^*)\lambda_A+(1-\theta)(1-\xi)(p+\epsilon)\lambda_B}{(1-\xi)\left[2\theta(1-\gamma^*)+(1-\theta)(p+\epsilon)\right]}+(1-p-\epsilon)\lambda_B- \\ -\frac{2\theta\xi\lambda_A+(1-\theta)(\xi+1)\lambda_B}{2\theta\xi+(1-\theta)(\xi+1)}\Bigg]D := \bar{\phi}. \tag{18}$$

Since $\lambda_B < \lambda_A$, condition (18) is more restrictive than condition (17). If type B wants to solicit a rating after an assessment $m=h$, then type A wants to solicit a rating as well.

On the other hand, for $s^*(B,0)=0$, paying the fee to solicit a rating, which is H with a probability p and L with a probability $1-p$, is not worth for type B: $q(0,0)D+\lambda_B(R-D)+(1-\lambda_B)r > p\left[q(1,H)D+\lambda_B(R-D)+(1-\lambda_B)r\right]+(1-p)\left[q(1,L)D+\lambda_B(R-D)+(1-\lambda_B)r\right]-$

$\phi(D,\gamma)$. Substituting and rearranging, we obtain the following condition:

$$\phi(D,\gamma^*) > \beta\Bigg[p\frac{2\theta(1-\xi)(1-\gamma^*)\lambda_A + (1-\theta)(1-\xi)(p+\epsilon)\lambda_B}{(1-\xi)\left[2\theta(1-\gamma^*)+(1-\theta)(p+\epsilon)\right]} + (1-p)\lambda_B - \\ -\frac{2\theta\xi\lambda_A + (1-\theta)(\xi+1)\lambda_B}{2\theta\xi+(1-\theta)(\xi+1)}\Bigg]D. \tag{19}$$

And, if they receive a negative assessment $m = l$, type B prefers again not to solicit a rating $s^*(B,1) = 0$: $q(0,0)D+\lambda_B(R-D)+(1-\lambda_B)r > (p-\epsilon)\left[q(1,H)D + \lambda_B(R-D) + (1-\lambda_B)r\right]+ (1-p+\epsilon)\left[q(1,L)D + \lambda_B(R-D) + (1-\lambda_B)r\right] - \phi(D,\gamma)$. Thus,

$$\phi(D,\gamma^*) > \beta\Bigg[(p-\epsilon)\frac{2\theta(1-\xi)(1-\gamma^*)\lambda_A + (1-\theta)(1-\xi)(p+\epsilon)\lambda_B}{(1-\xi)\left[2\theta(1-\gamma^*)+(1-\theta)(p+\epsilon)\right]} + (1-p+\epsilon)\lambda_B - \\ -\frac{2\theta\xi\lambda_A + (1-\theta)(\xi+1)\lambda_B}{2\theta\xi+(1-\theta)(\xi+1)}\Bigg]D := \underline{\phi}. \tag{20}$$

Since $\epsilon > 0$, if $\theta(D,\gamma^*)$ satisfies condition (19) it also satisfies (20) .

Conditions (18) and (19) verify the proposed equilibrium choices. These choices confirm the equilibrium beliefs.